AMERICAN ANTIQUITY

VOLUME 69 NUMBER 1 JANUARY 2004

SAA

SOCIETY FOR AMERICAN ARCHAEOLOGY

FORUM

THE HOUSE OF THE SEA: AN ESSAY ON THE ANTIQUITY OF PLANKED CANOES IN SOUTHERN CALIFORNIA

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The Chumash tomol, *a sophisticated planked canoe, came into use in the Santa Barbara Channel region of Southern California about 1,500 years ago. It is often assumed that planked watercraft were first developed in the region at about that date. This paper argues, on theoretical grounds, that planked canoes were developed much earlier in Southern California, perhaps as early as 8,500 years ago.*

Hace 1,500 años, el la región del canal de Santa Barbara en el sur de California, se comenzó el uso de una canoa sofisticada hecha de tablas gruesas (tomol en la lengua Chumash). Se ha asumido que canoas de este tipo de manufactura fuerón desarolladas por primera vez durante este mismo período. Este ensayo argumenta desde una base teórica que las canoas de tablas gruesas fuerón desarolladas con mucha mayor anterioridad en el sur de California, talvez hace 8,500 años.

The Chumash Indians of Southern California were among the most complex hunter-gatherer societies in North America in the fifteenth century A.D. They are famous for their sophisticated maritime adaptation, centered on the Santa Barbara Channel, for their elaborate ritual, fine rock art, and long-distance exchange. Chumash seafarers are celebrated for their planked canoe, the *tomol*, with which they ventured offshore to the Channel Islands and in search of deep-water fish (Arnold 1995; Gamble 2002). The Chumash themselves were well aware of its importance in their culture and called it the "house of the sea." Thanks to the researches of the Smithsonian anthropologist John Peabody Harrington and his Ventureño Chumash consultant Fernando Librado, we know a great deal about historic *tomols*. The Smithsonian anthropologist commissioned a replica of this remarkable canoe in about 1912, the construction supervised by Librado himself, one of the last people to see *tomols* in use, for they died out rapidly after 1850, within his lifetime. Harrington left copious notes on *tomol* construction and handling, sufficient to allow the construction of the *Helek*, a modern-day replica, in 1976 (Hudson et al. 1978).

Jeanne Arnold (1995, 2001) has rightly drawn attention to the *tomol's* central role in the developing complexity of Chumash society. Lynn Gamble (2002) has recently summarized the archaeological evidence for the first appearance of planked canoes in the Chumash homeland. She assembled a jigsaw puzzle of finds, such as asphaltum plugs, boatbuilding tools, and plank fragments, which take the story back to about A.D. 650, perhaps earlier. This date also coincides with a dramatic expansion of seafaring along the shores of the Santa Barbara Channel.

But the archaeology still leaves a fundamental question unanswered. Was the *tomol* a recent invention on the part of Chumash canoe builders? Or did simpler forms of planked watercraft develop much earlier along the Southern California coast? As a long-term small-boat sailor, I have always wondered about the antiquity of planked canoe technology in our waters from a non-archaeological perspective—that of the realities of open-water seamanship. The question occurs to me forcibly on those many days when the Santa Barbara Channel is far from mirror calm. Many times, I have started the passage from the mainland in the calm of morn-

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American Antiquity, 69(1), 2004, pp. 7–16

ing, with barely a ripple on the ocean. Two hours later, approaching Santa Cruz Island and that locally famous patch of water known as Windy Lane, a strip of water where the prevailing westerlies funnel southward from Point Conception, I have found myself reducing sail and donning foul-weather gear. While the modern-day sailing yacht merely continues on her way, a planked canoe with its low sides would soon be in serious trouble. One mentally shudders at paddling a *tomol* in such conditions—where the wind is often no more than 15 knots across the deck, a moderate breeze compared with what the Channel is capable of generating.

As Librado told Harrington, most Chumash voyaging took advantage of the calm times of day and the quiet intervals between storms in the winter. But, even then, the dangers of being caught out, of capsizing in a heavily laden canoe, were high. "Canoe faring is dangerous, and drownings are frequent," a Chumash canoeman named Juan Cansio remarked (Hudson et al. 1978:140). Librado told of another canoeman who was one of only six people out of 60 to survive a crossing from Cojo Anchorage near Point Conception to San Miguel Island, a notoriously windy part of the Santa Barbara Channel. Casualty rates must have been high, even with a conservative approach to voyaging necessitated by watercraft that were difficult to paddle against head winds and steep seas. Voyaging conditions in the Channel made efficient watercraft essential, long before Chumash culture achieved its Late Period sophistication.

The common assumption that *tomols* originated about 1,500 years ago implies that these well-developed canoes suddenly appeared, Zeus-like, from nowhere as a fully fledged design. I believe that such boatbuilding technology developed thousands of years before the *tomol* plied Southern California waters.

Not for a moment do I question the need for solid archaeological evidence to document early boatbuilding in Southern California, or elsewhere for that matter, and that evidence supports an appearance of planked canoes within the past 2,000 years or so (Gamble 2002). But I do think there is room for intelligent speculation on the subject based on other factors such as durability, navigability, and seaworthiness. During the process of writing a popular account of California archaeology at the behest of the Society for California Archaeology (Fagan 2003), I found myself pondering the implications of such well-documented early sites as Eel Point on San Clemente Island, over 73 km offshore, occupied as early as 8,500 years ago (Cassidy et al. this issue). Then there are other early sites, such as the still only partially dated Little Harbor site on Santa Catalina Island, well over 20 nautical miles offshore, and well-documented visits to San Nicolas Island, 98 km from Point Hueneme, as early as 5,400 years ago (Altschul and Grenda 2002). The Middle Holocene inhabitants of the Nursery Site on San Clemente Island used redwood supports for their dwellings. While these may have been driftwood, they could equally well have been recycled from old canoes, or timber could even have been carried from the mainland (Altschul and Grenda 2002). The settlement of such locations on anything more than a purely transitory basis required not occasional voyaging, but regular passages between mainland and offshore islands. As various scholars have pointed out, you cannot think of communities on these remote landmasses as functioning in isolation (Altschul and Grenda 2002; Raab 1997). Such voyaging required durable, fast canoes—hull designs only achievable with planked hulls.

This, then, is a theoretical essay on ancient Southern California watercraft. If it provokes some discussion of an issue with much wider implications than merely those of Southern California archaeology, then it has succeeded in its modest goal.

Balsa, Dugout, or Skin Boat?

Any discussion must begin with historic watercraft and their qualities. Before European contact, native Californians used three main types of watercraft, most of them confined to inland lakes and rivers, sheltered estuaries, or the calm waters inside the near-ubiquitous kelp beds close offshore—balsas, dugouts, and the *tomol.*

Dugout canoes, fashioned from hollowed out logs, are ancient watercraft, used by humans throughout the world since the end of the Ice Age, perhaps earlier. Southern Californians were diligent users of these, the simplest of watercraft. A long tree trunk, usually poplar (cottonwood) or willow, served as the hull. Poplar, which grew along creeks, was especially valued, because the wood had straight grain and few knots (Hudson et al. 1978).

Southern California dugouts were never large, mostly in the 3.6 to 6-m range. They were far smaller than the great canoes of far northwestern California, which conducted a thriving coastal trade for nineteenth-century settlers and probably developed some centuries earlier (Gould 1968). There, canoe builders could call on unlimited supplies of straight-grained redwood trunks and fashion dugouts 12 m long or more. Their owners used them for fishing close inshore. On exceptionally calm days, they would venture cautiously up to 18 km out to sea, to isolated rocky outcrops where sea mammals or mollusks might be found. But even these expert skippers never went to sea in their huge dugouts when there was any ground swell or significant wind waves. Their canoes lacked the freeboard (high sides) to do so safely.

Dugouts have serious limitations, whether built for ocean or river use, because of their rounded bottoms and low freeboard. They are inherently unstable, tipping at the slightest provocation. Oddly enough, one of the best ways to paddle one is standing up, so that you can balance the craft more effectively—once you have learned the knack. In historic times, and according to Harrington, Southern California dugouts served for fishing and transportation on shallow estuaries, and in calm inshore waters, poled or paddled by a sitting, standing, or kneeling paddler (Hudson et al. 1978). Such narrow, low-slung craft were hazardous in the smallest wind waves, and could not be readily launched through surf of any height. Dugouts are really estuary and inland watercraft, although there is a record of a "poplar dugout" being paddled from Goleta Estero to Ventura, a passage of over 50 km (Hudson et al. 1978:35). But one can be sure that the weather was flat calm, with minimal ground swell on that particular day, and that the canoe hugged the shoreline, so the crew could head for the beach if conditions deteriorated.

We should also mention skin boats in passing, as they figure in theories about Pacific coast passage-making. Skin boats were never widely used in ancient California, but have attracted attention from scholars interested in maritime adaptations in the far north and further south (Erlandson 2001). The Eskimo *umiak*, the indigenous skin boat of the Arctic, is considered a potential oceangoing prototype for long-distance voyaging down the Pacific coast. There is no evidence, either archaeological or historical, for *umiak*-like vessels along California's coasts. Nor can we be sure that such craft would survive the large swells and strong winds of the open Pacific north of the Conception and the Bay area. Even on calm days, the ground swell is such that landing from even sheltered beaches can be a difficult proposition. One could argue that a crew could land if conditions deteriorated, then wait for them to calm down again, but this argument misses the point—the Northern and Central California coasts are inhospitable for long passages by open watercraft even on calm days, especially if they are carrying heavy loads.

In theory, anyone familiar with house building and sewing could build a small skin boat by stitching together seal or sea lion hides. But there is no ethnographic record of such vessels in California, except occasionally, perhaps, as inland or lagoon craft—and even then they are very rare. As far as we know, no one in California mastered the craft, probably because conditions on the open ocean were too rugged. (There is a single record of a skin boat among the Chumash made with shark skin hide, but it was probably not an indigenous type [Hudson and Blackburn 1982]).

Balsas (reed canoes) also have a seductive pull for the scholar, largely because they are simple to build and the raw materials to construct them are found widely on the mainland. There were more than 728 ha of tule-producing estuary along the mainland coast in Chumash country as recently as 1980 and many more on the continental shelf of earlier times (Arnold 1995). (Tule reeds are scarcer on the Channel Islands.) This material made excellent vessels for use in sheltered water—bundles of reeds tied together into simple rafts (flat platforms) and canoe-shaped watercraft with an interior cavity that could be poled or paddled on lakes, rivers, and even close to the sea shore.

Small balsa canoes, when dry and newly constructed, are buoyant and easily handled in the surf. They have the advantage of being quick to manufacture from dried reeds wrapped into three bundles tied together to make a small canoe, or five tule bundles to increase freeboard. But were they true seagoing craft in Southern California?

Reed boats were commonplace in many areas during the past 5,000 years. The ancient Egyptians used papyrus boats on the calm waters of the Nile, as did the Mesopotamians on the Tigris and

Euphrates. Reed canoes plied the waters of Lake Titicaca in the Andes and fished close to the Pacific shore. There are always the wishful thinkers, who envisage bold ocean voyages to America by ancient Egyptians in fleets of reed boats, like the Norwegian explorer Thor Heyerdahl, who tried to cross the Atlantic in a so-called replica of an Egyptian papyrus reed boat, the *Ra*, in the late 1960s (Heyerdahl 1971).

Many styles of reed canoes were used by 30 tribes from Baja California to Oregon on the Pacific, but they were not long-distance vessels (Cunningham 1989). The smaller Chumash reed canoes were "three-bundle" craft, stiffened with a willow pole, which allowed them to carry a load. One bundle served as the bottom of the canoe, the other two as the sides. The tied ends of all three bundles formed a pointed bow and stern. Such canoes were wide enough to allow a paddler sitting on the bottom bundle to propel them easily with a double-bladed paddle (Hudson et al. 1978). According to nineteenth-century Chumash informants, a three-bundle balsa could venture out on the Pacific and carry one or two passengers, provided they did not mind getting wet and the canoe stayed close inshore. Some three-bundlers may have been as much as 4.3 m long.

"Five-bundle" canoes were more substantial vessels, with a chunky bottom pallet of thick reeds forming the bottom. The remaining four bundles were smaller and formed the side "planks." These "planks" were thinner bundles than the base, only the lowermost ones being tied to the bottom, while the uppermost ones were secured to their neighbors alone. This provided a flexible, higher, and more durable hull than the three-bundled version. The builders sometimes inserted as many as three driftwood seats or braces between the reeds (Hudson et al. 1978). Once completed, Chumash five-bundle canoes were coated with asphaltum to prevent the reeds from becoming waterlogged.

Like their three-bundle cousins, the larger balsas were light and buoyant, easily carried and launched. According to Chumash informants, some larger canoes journeyed to the Channel Islands, but they had serious limitations. There is also a historical record of such a vessel crossing to Catalina Island (Harrington 1933), but whether this was an isolated occurrence we do not know. Even a lightly burdened five-bundle balsa was laborious to paddle in any sea and leaked copiously. Speed over the water was of the essence, lest one got caught out in afternoon breezes and wind waves. According to Fernando Librado, five-bundlers became completely waterlogged and useless after only four days in the water, which inhibited a great deal of longer-distance paddling. Even after short journeys, their owners were careful to dry them in the sun as often as possible.

For the most part, balsas were used for inshore fishing, often with a large basket set amidships for the catch. Their penchant for waterlogging did not matter when fishing in the kelp, as you would probably get wet in the surf anyhow, and you were never afloat for more than a few hours. Nor would it matter so much if the crossing to the islands was a mere 9.6 km or so, as it was before about 10,000 B.C.

According to Chumash informants, some larger balsas were built as more serious passage makers with higher, planklike sides, the reed "planks" caulked with fiber and bitumen, as a substitute for the wooden *tomol*. Apparently, such vessels were called into use when driftwood and other timber was in short supply. This may have been the kind of vessel that the Spanish priest Fray Boscana recorded as crossing to Catalina. But such craft cannot have been a long-term substitute for the durable and much tougher *tomol*.

With dugouts as potential death traps and tules liable to partially submerge in mid-Channel and very difficult to paddle in anything but the calmest water, we are left with only one alternative—some form of planked canoe.

Technology and Skills

Any planked canoe, however simple, was a much more formidable proposition to build than a balsa. The Chumash *tomol* was an expensive and time-consuming project. According to Fernando Librado, canoe builders would take between two and six months to assemble a single *tomol*. Most canoes were between 3.6 and 9 m long, with a .9-m beam, large enough to carry between three and six men and a heavy load. At the same time the vessel had to be light enough for her crew to carry and beach readily.

With good reason, canoe builders were treated with respect for their skills at fashioning rough driftwood or local timbers into carefully split, shaped, and thinned planks. Each canoe was a

patchwork of planks large and small, sewn together with plant fiber and caulked with a mixture of bitumen and pitch. The only cross member was a beam that braced the hull amidships, inserted between the fifth and sixth rows of planks. The smoothly finished hull was sealed with a mixture of red ocher and pine pitch, which prevented the canoe from becoming saturated and unduly heavy.

Building a *tomol* could take up to 540 hours, making them an expensive proposition for all but wealthy individuals (Hudson et al. 1978). Earlier planked canoes may also have been time-consuming to manufacture, but the planked hulls could well have been simpler, and perhaps not so well built. We simply do not know. But we cannot assume that building a planked canoe required sophisticated technology. The technology used by Chumash canoe builders was just the basic toolkit used in daily life adapted slightly for boatbuilding—variations of woodworking artifacts and skills that were as early as human occupation in California. None of the stone or shell adzes, gouges, scrapers, or even the sharkskin "sandpaper" used by the Chumash canoe builders, were of any great sophistication, even if they became quite refined (Gamble 2002), but these artifacts did the job thoroughly and well and could easily be replaced if they wore out. Every Chumash, man, woman, or child learned the qualities of vegetable fibers from an early age, for they used them to build dwellings, to secure loads, and to bind spearheads to shafts. Exactly the same knotting and twining skills were applied to canoe planks, while the caulking treatment of seams was a variation of that used on baskets and on balsas, even if different formulations were used. One could not survive in daily life ashore without these basic technological skills.

The actual process of canoe building was another matter, however, involving instincts and visualization skills that were far more important than the technology. They came from a mindset passed down from generation to generation, a combination of unhesitating ability at handling simple tools, and, even more important, the art of visualizing a canoe's shape in one's mind without any wood in front of one. These are very much skills of a world not of power tools, but of handsaws and wood scrapers, familiar to anyone who builds wooden boats.

Some years ago, I watched an elderly shipwright fit a new plank to an old wooden sailing dinghy. He had removed the rotten timber and held a length of mahogany in his hands, feeling it, massaging it, without a tape measure in sight. With unerring eye, he shaped the wood with a hand plane, beveled the edges and lapped it against its neighbors. Every movement was unhurried, deliberate, turning a straight plank into a three-dimensional shape that fitted precisely into place with just a little extra planing to fine-tune the set. A lifetime of boatbuilding went into the fitting of this plank, a skill basically the same as the plank-fitting expertise of ancient canoe constructors. Today, only a few lucky people have the gift of being able to think three dimensionally, men and women who are good with their hands and have an instinct for the qualities of wood. Small wonder the Chumash and, one assumes, their predecessors, revered individuals who were canoe builders—just as they honored the captains of planked vessels, who had unusual instincts and seamanship skills that enabled them to make safe passages offshore. But they respected not technology, but *skills*.

Librado's manual on *tomol* building required no elaborate artifacts, but great skill in selecting driftwood for the canoe. Here experience came in, as it does when splitting logs with whalebone wedges and stone hammers. Plank splitting is a simple woodworking technique requiring experience rather than minute finesse. I once watched British archaeologist Francis Pryor split planks from a straight-trunked ash with some oak wedges and a hammer. The tools were simplicity themselves—little changed from the Stone Age. The skill was in watching the split, literally listening to the wood as it split open in response to the wedges. A long, straight split had a distinctive sound, a language of its own to an expert woodsman.

Pryor was demonstrating Bronze Age working methods, which had been widely used by earlier Stone Age farmers and were still employed 2,000 years later by Medieval carpenters erecting local church roofs (Fagan 1995). His planks were remarkably straight and of even thickness. Many western woods like poplar split equally easily, so the production of planks was a matter of instinct and skill rather than elaborate technology, something done on a regular basis and not just to build canoes.

The real art of the canoe lay in generations of

boatbuilding skills, passed carefully from one generation to the next, and a craft that had an exotic touch to it, which probably gave it strong supernatural associations. The Chumash Brotherhood of the Canoe was associated with important rituals and myths, which lay at the core of the arts of boatbuilding and navigation over open water. Undoubtedly, these beliefs and ceremonies, as well as the skills needed to build planked hulls, had roots in much earlier canoe-building traditions. There is a lesson here: we should be thinking about boatbuilding skills, more than just about the technology used in the construction process.

The Seagoing Qualities of Planked Canoes

Even simple planked vessels enjoy several important advantages over dugouts or reed canoes. They have higher sides, which make them more seaworthy in open water. The same freeboard also increases the chances of survival if one is caught out, for, *in extremis*, one can stabilize the boat somewhat by sitting crew members on the gunwales.

Planked canoes can take years of rough use, do not become waterlogged, and can be repaired if they spring a leak or are damaged. The initial labor investment required to build them was much more than for a reed vessel, but they could be used for years before wearing out or needing extensive repair, especially if maintained carefully. *Tomols* received harsh use, especially when launched and landed through surf. They had to be light enough for the crew to carry into the surf line, ready for a rapid launch when a quiet interval allowed safe launching through the breakers. According to Librado, historic Chumash canoe captains were conscientious in their maintenance, and with good reason.

A planked canoe has a much greater load capacity than a dugout or balsa. Load carrying is an important consideration for paddlers who are traveling long distances carrying food, or commodities to trade, and returning with a heavy cargo of fish or trade goods. As is well documented during the Middle and Late Periods, *tomols* were also excellent platforms for offshore fishing, or towing slain sea mammals.

Lastly, the *tomol* and other planked craft were much easier to paddle and handle in both smooth seas and rougher water, allowing their crews to maintain a relatively high cruising speed in calm conditions. Much depended on careful ballasting. Fernando Librado describes the sea trials of a newly completed canoe: "Once they have completed the *tomol*, they put it into the sea and row it about, seeing if there is anything wrong with it. . . . They check for leaks and whether or not the canoe is lopsided or sinks too deeply into the water" (Hudson et al. 1978:121). The master builder himself also ballasted the canoe, for its light structure required considerable inboard weight to achieve stability. In 1976, the *Helek* carried five sandbags with a total weight of 147 kg. Once saturated, they provided the necessary stability. The replica carried a crew of four men, their double paddles and personal gear, for a total dry weight of 544 kg. When fully loaded, it could carry between 1,587 to 1,814 kg. Even when laden, the *tomol* was easily propelled with traditional paddles in calm water.

The *Helek's* crew found their speed depended on the wind direction. With an eight-knot following wind and swell or in calm conditions, they could make six to eight knots. But if the same eight-knotter blew from ahead, the *tomol* made virtually no headway against wind and waves. An average speed may have been in the three- to four-knot bracket. Canoe skippers only ventured offshore when conditions were calm, and occasionally at night, when they navigated by the stars (Hudson et al. 1978).

A planked canoe, whether a *tomol* or a craft of basically similar design, could easily be propelled at an average speed of seven knots across calm open water. At this speed, and under such ideal conditions, it could cross from, say, the Santa Barbara area of the mainland to Santa Cruz Island, just over 32 km, in four hours or more, or from Catalina to San Clemente in the same time. Three-hour periods of calm weather are commonplace in Southern California waters, and easy to forecast if one knows local conditions. These calm "windows" were the secret to successful *tomol* passage-making. However, Librado stressed that most crossings in the Santa Barbara Channel were over the shortest possible distance, from Point Hueneme to Anacapa Island, with only short stretches of open water to navigate thereafter. Some of the best passage-making weather occurred during the winter months, when periods of complete calm separated winter storms. (It should be noted that recent passages in replica *tomols* have taken up to 12 hours to go from near Point Hueneme to Santa Cruz

Island, a distance of some 40 km, but this includes stops for rest and to change crews. Much fitter ancient crews who paddled regularly at cruising speed probably made faster passages.)

Rising Sea Levels and Prototypes

Why, then, did planked canoes come into being? If the Arlington Springs woman from Santa Rosa Island is correctly dated, then mainlanders were visiting the northern Channel Islands as early as 13,200 to 13,500 B.P. (Johnson et al. 2002), or people had settled there from the north and lived independently of the coast. The latter is an unlikely proposition, given the rough waters off Point Conception and the biologically impoverished islands of the time. Jon Erlandson (1999) has investigated sites in San Miguel Island, among them Daisy Cave, which are securely dated to at least 9,500 years ago. At the time, low Ice Age sea levels exposed large areas of continental shelf, and the northern Channel Islands were a single landmass—Santarosae. During the late Ice Age, the distance between the mainland and what is now Anacapa Island was only about 9.6 km, a much shorter canoeing distance than that of today. Such a brief open water passage would be entirely feasible in a tule canoe. The transit time would be short enough to avoid serious waterlogging and the journey completed before any midday winds blew up. But, after 10,000 B.P. or thereabouts, sea levels rose rapidly, creating a much wider Channel and far more hazardous conditions offshore. I believe that these rapidly increasing distances may have been the catalyst for the development of more sophisticated watercraft, the time when canoe builders turned to wooden planks to acquire more durable, faster, and drier boats capable of making 30-km or longer passages offshore.

Nor do we have to look far for the prototype: either a dugout canoe or the balsa. Hudson and his colleagues (1978) preferred the dugout, suggesting that a few driftwood planks were added to such vessels to make them more seaworthy. Johnstone (1980) also believes that the planked canoe originated from such vessels. I suspect that they may be wrong, because the first wooden canoe builders had a convincing seagoing prototype in front of them—simple craft like the five-bundle reed canoe with its "planked" sides (Figure 1), even if they used the outside portions of tree trunks for the bottom of the planked vessel. The woodworking skills required are commonplace ones, even if the expertise needed to visualize and construct a wooden canoe is specialized, and distinctive. Building a planked canoe takes a lot of time and skill, but there was a payback: the resulting vessel was much more seaworthy and lasted many years. As Jeanne Arnold (2001:24) aptly puts it: "just minutes a day invested in advance."

Discussion

The archeological record from the northern Channel Islands documents settlement or sporadic visitation by mainland groups since early Paleoindian times. These visits took place at least 11,500 years ago, at a time when the distance between Santarosae and the mainland was much shorter than today. There is no reason why larger balsas could not have traversed what was then a relatively narrow, if growing, strait, using the calm hours of the day, but it should be stressed that we do not know if the prevailing westerly winds of today were already dominant along the coast. However, the presence of a narrow defile of only some 10 km or slightly more makes it almost inevitable that stronger than normal winds funneled down the strait when westerlies, or, for that matter, southeasterlies, were blowing. Judging from modern conditions, the funneling breeze could be as much as 10-to-15 knots stronger than that blowing over open water. Such conditions would create problems for reed canoes, as the strong winds off Anacapa Island can for small craft today. But the use of balsas in early millennia certainly fits the documented pattern of occasional, perhaps seasonal, visits for fishing and mollusk collecting.

The distances offshore increased dramatically with the rise of sea levels after about 11,000 years ago, at a time when we may safely assume that near-modern wind and sea conditions prevailed in Southern California waters. When sea levels stabilized at near-modern levels by 6,000 years ago, even the shortest distance offshore was over double that of the late Ice Age. By that time, however, there is unimpeachable evidence of substantial human settlement on both San Clemente and Santa Catalina Islands. To reach Catalina involves a passage of more than 32 km. Assuming that most canoes journeyed from island to island, using line-of-sight navigation, a skipper going to San Clemente would go

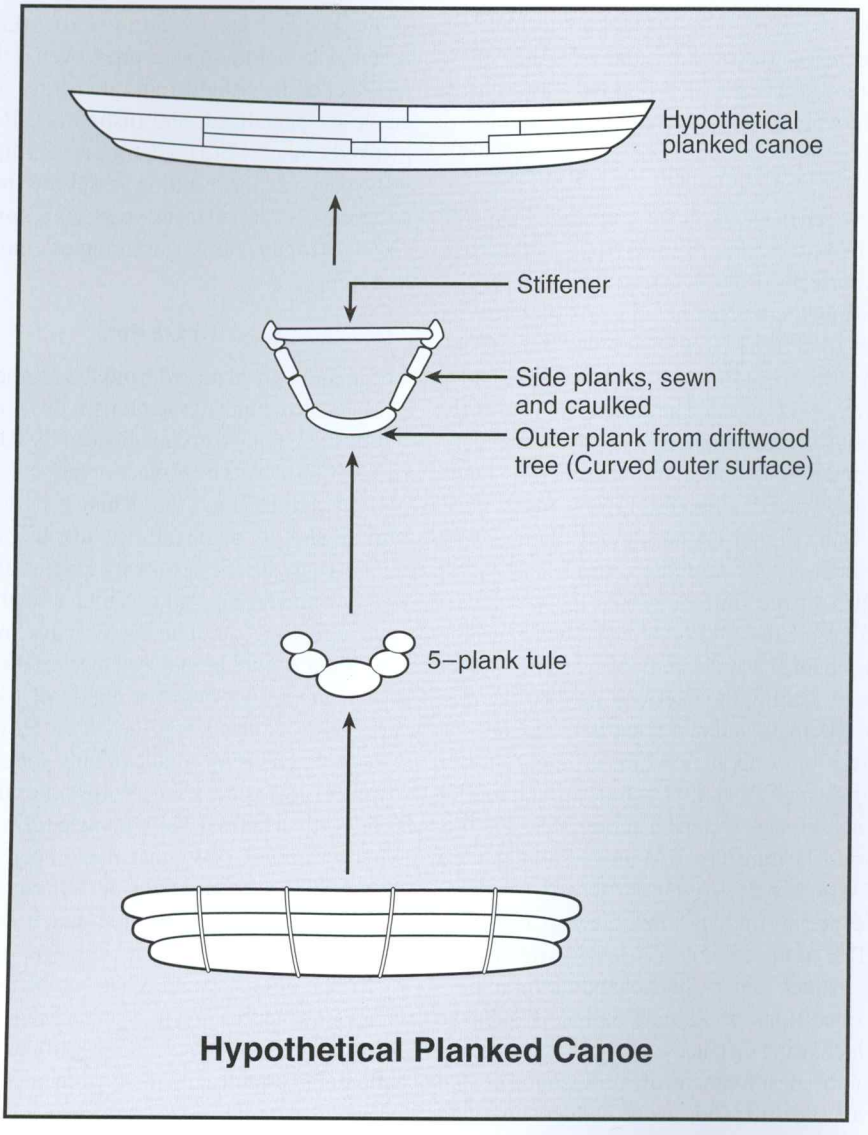

Figure 1. A hypothetical early planked canoe and its five-bundle balsa prototype.

to Catalina, then paddle another 32 km to San Clemente over the outer waters of the San Pedro Channel when favorable conditions allowed him to continue. Neither of these passages could be undertaken in any open craft except a more seaworthy planked canoe.

The Eel Point site on the western side of San Clemente, with its intensive dolphin hunting and sea-mammal exploitation, is especially important to our argument. Such a community, and others like it, may have survived in isolation on San Clemente—we do not know. More likely, they maintained at least sporadic links with mainland groups. If this is true, then canoe voyages must have been regular events, carrying people and essential mainland commodities out to the islands, and bringing people, mollusks, dried sea-mammal flesh, or fish to the coast. These canoes must have been heavily laden, and have been of some size, work horses rather than easily waterlogged watercraft used for fishing off the surf and in the kelp. Their crews spent many hours far offshore, sometimes in swells and waves that would swamp and waterlog a reed canoe.

If you weigh the factors of seamanship, load carrying, paddling speed, and conditions offshore on

the average day, then the theoretical arguments for planked canoes seem overwhelming. It remains, of course, to find traces of such watercraft in the archaeological record. The only clues may lie in some stone tools from Eel Point, which include drills and scrapers said to be very similar to those used by Chumash canoe builders (Cassidy et al. this issue), but later canoe-building toolkits were certainly more specialized. Gamble (2002) has studied the archaeological evidence for planked canoes in great detail, including surviving plank fragments, asphaltum plugs, and the stone drills used to drill as many as 1,400 holes for a single canoe. She identifies a tri-facial drill as the tool used for the purpose, an artifact whose distribution coincides with that of planked canoe of recent millennia (Heizer and Massey 1953). Such objects may date to as early as 4500 B.P., but the evidence is still very inadequate. Gamble's comprehensive study begs the question as to what earlier canoe-building tools might have been like. Do the Eel Point "drills" and other artifacts represent such a simpler toolkit? Only future research will provide answers.

We know that bead exchange networks extended offshore by 4500 B.P. Exotic shell beads have come from both the Little Harbor site and the Nursery site on San Clemente Island, again hints of regular passage-making between island and mainland. It is fascinating to speculate about the social changes that must have resulted from the rising importance of canoe builders and skippers in this early maritime world. Those who built canoes and navigated them from mainland to offshore islands must have enjoyed growing prestige in coastal societies, for it was they who made possible the regular contacts between coast and island, between fellow kin and others living long distances apart over water. From such prestige and control of exchange networks must have come some form of social distinction, and eventually ranking, where political, social, and economic power lay in the hands of the few people who controlled planked canoes and travel over the open ocean. This distinction may have manifested itself in such institutions as membership of special groups, perhaps simpler equivalents of the Brotherhood of the Canoe, which played such an important part in Chumash society. Like the planked canoe, the Brotherhood may well have roots in earlier, simpler institutions, which provided the precedent, and impetus, for the historic institution.

I believe that rising sea levels and a need for offshore voyaging over longer distances may have served as the catalyst for planked canoes to appear in the Santa Barbara Channel and further afield in Southern California. Unfortunately, the archaeological record for these critical millennia is sporadic and often much eroded. It behooves us to look for the inconspicuous traces of planked canoes such as stone tools and asphalt plugs in sites dating to many centuries before the *tomol* helped transform Chumash society after 1,500 years ago, even if, in fact, Cunningham (1989) is correct in suggesting that the Chumash lacked suitable containers for boiling tar and pine pitch until they obtained steatite from Catalina Island. All my instincts as a seaman, and, for that matter, as an archaeologist, suggest that such clues will come to light in the future.

Acknowledgments. I am grateful to Jim Cassidy, Don Grenda, Bill Hildebrandt, Terry Jones, and Mark Raab, among others, for critique and stimulating discussion of earlier versions of this paper. Four anonymous reviewers also provided valuable insights. Carlene Sanchez very kindly translated the abstract into Spanish. The drawing is the work of Steve Brown of Artworks, UCSB.

References Cited

Altschul, J., and D. Grenda
2002 *Islanders and Mainlanders*. SRI Press, Tucson, Arizona.

Arnold, J.
1995 Transportation Innovation and Social Complexity among Maritime Hunter-Gatherers. *American Anthropologist* 97:733–747.

Arnold, J. (editor)
2001 *The Origins of a Pacific Coast Chiefdom: The Chumash of the Channel Islands*. University of Utah Press, Salt Lake City.

Cunningham, R.W.
1989 *California Indian Watercraft*. EZ Nature Books, San Luis Obispo, California.

Erlandson, J.
1999 Maritime Subsistence at a 9,300-Year-Old Shell Midden on Santa Rosa Island, California. *Journal of Field Archaeology* 26:255–265.
2001 The Archaeology of Aquatic Adaptations: Paradigms for a New Millennium. *Journal of Archaeological Research* 9:281–350.

Fagan, B.
1995 *Time Detectives*. Simon and Schuster, New York.
2003 *Before California: An Archaeologist Looks at Our Earliest Inhabitants*. AltaMira Press, Walnut Creek, California.

Gamble, L.
2002 Archaeological Evidence for the Origin of the Plank Canoe in North America. *American Antiquity* 67:301–315

Gould, R.
1968 Seagoing Canoes among the Indians of Northwestern California. *Ethnohistory* 15(1):11–42.
Harrington, J. (editor)
1933 A New Original Version of Boscana's Historical Account of the San Juan Capistrano Indians of Southern California. *Smithsonian Institution Miscellaneous Collections* 92(4).
Heizer, R. F., and W. C. Massey
1953 Aboriginal Navigation off the Coasts of Upper and Baja California. *Bureau of American Ethnology Bulletin* 152:282-311.
Heyerdahl, T.
1971 *The Ra Expedition.* Doubleday, New York.
Hudson, T., and T. C. Blackburn
1982 In *The Material Culture of the Chumash Interaction Sphere, Vol. 1: Food Procurement and Transportation.* Anthropological Papers No. 25. Ballena Press/Santa Barbara Museum of Natural History Cooperative Publication, Los Altos and Santa Barbara, California.
Hudson, T., J. Timbrook, and M. Rempe
1978 *Tomol: Chumash Watercraft as Described in the Ethnographic Notes of John P. Harrington.* Santa Barbara Museum of Natural History and Ballena Press, Santa Barbara, California.
Johnson, J. R., T. W. Stafford, Jr., H. O. Ajie, and D. P. Morris
2002 Arlington Springs Revisited. In *Proceedings of the Fifth California Islands Symposium*, edited by D. R. Brown, K. C. Mitchell and H. W. Chaney, pp. 541–545. Santa Barbara Museum of Natural History, California.
Johnstone, P.
1980 *The Sea-Craft of Prehistory.* Harvard University Press, Cambridge, Massachusetts.
Raab, M.
1997 The Southern California Islands During the Middle Holocene. In *Archaeology of the California Coast during the Middle Holocene*, edited by J. Erlandson and M. Glassow, pp. 167–184. Institute of Archaeology, University of California, Los Angeles.

Received October 23, 2002; Revised June 20, 2003; Accepted June 24, 2003.